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# INSTRUCTION MANUAL



**Unit series:**☐**SCAE**☐**SCAE...H**☐**SCAC**☐**SCAC...H**☐**RSA**☐**RHSA**☐**SMAE**☐**SMAE...H**☐**MAE+TCX**☐**MHAE+THCX**☐**DUO**☐

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## Installation, operation and maintenance instructions are given as a guide to good practice in the installation, putting into service, operation and maintenance, of this unit

This manual is written in the language of the country where the unit is expected to be installed. If the language is different from that of the envisaged country please ask your dealer for a copy prior to installing or using the unit and inform ACM's Customer Service by fax if possible, at this number: 0039/49/8931271, stating the manual code number.

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### Foreword

This unit must be used for its designed purpose without exceeding operating limits.

The instruction manual is an integral and essential part of the unit.

Read this instruction manual through carefully as it provides a very important guide to installation, use and maintenance safety. This manual must be kept in a safe place and always put back after consulting it. A.C.M. srl declines all responsibility for damages to persons or things due to the failure to comply with the instruction safety rules of this manual or due to the improper use of the unit itself.

It is absolutely compulsory to follow the instructions given in the manual regarding installation, start up, use and maintenance for safety reasons, correct operation and for the warranty.

Only **experienced (qualified) personnel** should install, start up and service this unit, as envisaged in this manual; by qualified personnel we mean people who have the necessary technical-professional qualifications for servicing electrical and refrigeration systems and who comply with the instructions provided on the unit, with those written in this manual and with the local safety rules and regulations.

Only **experienced (qualified) personnel** are authorized to access the inside of the unit.

Caution! There are moving and live parts inside the unit. It is compulsory to turn the main switch off and padlock it before removing the outside panels.

In all cases affix the warning: «**SERVICING - DO NOT CARRY OUT ANY MANOEUVRES**»

All vessels and containers subject to control by the competent authorities must be reported and subject to inspection and, if so requested, to regular inspection.

You will find the serial number books for such vessels and containers enclosed with this manual. The materials used for their construction and the gas they are filled with are all flameproof and flame retardant. However it is advisable to install fire extinguishers (using appropriate agents for the surrounding materials) near their installation site.



## Installation

Never work on live parts. The presence of a second person is recommended when connecting to the electricity mains, starting up or servicing, who can help in the event of electrical shock. If the unit has to be moved or lifted follow the instructions given in this manual carefully.

This unit contains substances that can damage the ozone layer. Do not release gas into the atmosphere: collect it and deliver it to authorised recycling centres.

Prior to using the unit check it is in good condition; if in doubt contact the supplier. Packaging materials, if there are any, must be handed over to collection centres as they are a potential hazard source if used improperly.

The unit must be anchored to a base strong enough to withstand its static load and possible stresses when running (wind force, snow, etc.).

If the unit is fitted with air intake and expulsion grids, the unit should be installed so they are free from obstacles and are not a nuisance or cause damage to people.

The units are filled with, or envisaged for filling with, R407C.

Any leak of gas must not be allowed to cause a dangerous concentration higher than 1250 ggm, equal to 4430 mg/m<sup>3</sup>, in rooms where there are people. To this end, installation must comply with ISO 1662 [UNI 8011, points 4.3, 6.1 and 6.3.1].

Direct expansion units are not allowed on premises where the mobility of people is limited (law courts, prisons, hospitals, etc.).

If the units are installed inside rooms where there are people, the pressure limiter device discharges must be conveyed to the outside.

Prior to making any electrical connections make sure that the rating plate data correspond to mains voltage.

The electrical supply circuit must be adequate to the unit's maximum absorbed power.

All electrical connections must be carried out in accordance with the instructions given in this manual and must also comply with the IEC 364 standards (HD 384) [CEI 64-8].

It is of paramount importance to check earthing system efficiency.

The hydraulic and refrigeration circuits or ducts must be expertly made according to the instructions given in this manual.

Before connecting the unit to the hydraulic and refrigeration circuits or ducts, wash or clean thoroughly all ducts.

If water is used its characteristics must conform to the data given in this manual.



## Maintenance

It is strongly recommended, to provide regular maintenance of your installation by a specialist in A.C.M. equipment. Regular maintenance ensures that any malfunction is detected and corrected in good time, and minimizes the possibility that serious damage will occur. Finally regular maintenance ensures the maximums operating life of the equipment

Tamperings or alterations of parts not authorized by the manufacturer could compromise safety and unit efficiency.

Damage due to misuse, tampering, lack of maintenance or failure to comply with the manufacturer's instructions will relieve ACM from all liabilities.

We would remind you that failure to respect certain installation and maintenance instructions may result cancellation of the A.C.M. warranty

The premises must be well ventilated before the welding units, tools with naked flames or high temperature parts are used because the thermal decomposition of possible refrigerant gases in the room causes the emission of highly toxic and corrosive fumes. It is highly recommended to keep the room well ventilated when repairing refrigeration circuits and to work on a circuit «washed» with nitrogen, and possibly with a flow of nitrogen.

If the unit is not going to be used for a long period of time:

- Turn the electricity off by removing the power cable from the main switch.
- Disconnect the hydraulic circuits and air ducts; drain the internal circuits.

If parts of the refrigeration circuit have to be removed, salvage the gas refrigerant and hand it over to an authorized collection center; fill the circuit with dry nitrogen at a pressure of 12 bar and seal shut. Close all unit accesses.




## Normal operation conditions

Cheek all wiring connection and trace the circuits to make sure that they agree with the enclosed wiring diagram. Wiring diagrams are furnished with unit, but extra copies may be obtained from A.C.M. Voltage is to be within plus or minus 10%. Of the voltage specified on the unit name plate frequency is to be within plus or minus 10%.

### Forbidden uses of the unit

- Do not use this unit for purposes other than those it has been designed for.
- Do not use it under operation conditions different from those described in this manual. If it has to be used under different operating conditions the manufacturer's prior consent must be obtained.
- Do not use this unit on premises where there are abnormal levels of dust, acids, corrosive gases or marine air, exposure to radiation's and EMC.
- Do not use this unit where there are explosion or fire risks.
- Do not install this unit where there are vibrations or shocks.
- Do not install this unit where there is no possibility of artificial lighting.
- Do not use the unit's electrical system to supply other devices (units, sockets, tools).
- Do not use this unit if protection grids or panels have been removed or are not firmly secured, or if locks are open.
- Do not use this unit if it has been tampered with or unauthorised alterations have been made.

	<b>INSTRUCTION MANUAL</b>
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## Identifying hazards and first aid measures

Accident sources are electricity, fluorohalogenates and internal moving parts.

### ELECTRICAL HAZARD

⚠ **Warning! Turn the unit off before helping the injured person.**

⚠

<b>Electrocution</b>	in shock	Keep the injured person on his back, resting, in a warm place. If necessary give him oxygen and ask for medical assistance.
	Loses consciousness and stops breathing	Give him artificial respiration immediately and ask for medical assistance.
	Fibrillation-heart failure	Give him a heart massage immediately and artificial respiration; ask for medical assistance.

### FLUOROHALOGENATES HAZARD

<b>High exposure to gas inhalation</b>	Anaesthetic effect, arrhythmia	Take the injured person away from the source of exposure. If necessary give him oxygen and ask for medical assistance.
<b>Sprayed with atomized liquid.</b>	Skin or eyes freeze-burnt	Wash the part immediately with clean warm water. If there is irritation or signs of blistering ask for medical assistance.
<b>Exposure to the irritating and toxic fumes of hydrogen chloride and hydrogen fluoride let into the room caused by thermal decomposition</b>	Inflammation of the mucosa of the respiratory tract.	Take the injured person away from the source of exposure and keep him in a warm place, resting. If necessary give him oxygen and ask for medical assistance.

### MOVING PARTS HAZARD

⚠ **Warning! Turn the unit off before helping the injured person.**

⚠

<b>Hit by fan impellers</b>  <b>Caught up and dragged by arms or legs</b>	cuts	Surface cuts should be medicated and bandaged with sterile material if possible. In all cases it is advisable to have them checked by a doctor. In the case of a haemorrhage, tampon with a possibly sterile gauze or bandage. If it is an artery that is haemorrhaging (bright red blood and pulsing) press the artery between the wound and the heart to stop haemorrhaging and ask for medical assistance. If contusions or fractures are suspected do not let the injured person move the arm/leg.
	wounds	
	amputations	
	contusion	



## **Rigging the unit according to label placed on panels**





## Filling the system

(if fitted)

**CAUTION:** the use of untreated or improperly treated water in this equipment may result in scaling, erosion, corrosion, algae or slime. The services of a qualified water treatment specialist should be engaged to determine what treatment, if any, is advisable.

The filling procedure is the follow:

- flushing and clearing of the system
- filling the system
- venting of the system

### **cleaning of system**

**CAUTION:** if a commercial flushing solution is used, the unit must be bypassed during flushing to prevent permanent damage to the unit tube.

If the unit is cleaned with water it is advisable to carry on the first filling with the valves closed and them to empty the water from the lower point of the circuit.

Open the valves and fill again circuit, make the circulation pump running for one hour tacking care to stop the pump every so often for short period of time. After the cleaning, clean the filter.

### **Filling the system**

Filling of the system can be carried out through the unit filling/draining cock of the unit.

It is recommended to fill the unit at a very low rate in order to prevent turbolences and consequently air pockets.

During the operation open all the unit's vent and the vents placed on the upper side of the system.

When the operation has been finished, close all the vents and valves previously opened.

### **Venting the system**

After the filling start the pump every so often cecking the venting through the manual and automatic vents of the circuit.

At the end the water flow must result regular and no noise of air pocket must be heard.

Ceck the pressure on the gauge and adjust it set point.

*caution: be sure the water rate is according with the same required by the project and, however it is higher than the minimum values figured in this manual.*



## Preparation for start-up

*Start-up should be carried out only by qualified and experienced personnel.*

### **PRELIMINARY OPERATIONS**

Before starting the unit, even only momentarily, make sure that following points are checked:

- With the main switch off, check that the electrical power connections and those of the auxiliary circuit comply with the instructions given on the terminal boards in this manual and with local and national codes.
- Check that unit voltage is within the voltage limits specified on the name plate.
- Open the main switch and check that all the connection terminals are tightly secured and clean. The mobile parts of the contactors and relays must be able to move unhindered. Make sure they are properly connected and tight.
- Remove any objects in front of the exchange coils that are hindering the free circulation of air.
- Check the circuit is filled with gas.  
This may be limited to checking pressures which should correspond to a saturation temperature near to room temperature.
- Check that oil level in the compressor's crankcase is at least half way up the indicator.
- Make sure that all the sensor bulbs are firmly inserted in their pockets and that the thermal conductor substance is there.
- Make sure that all air and water connections have been made correctly.



## Start up procedure :

- Check the compressor's intake and discharge cocks and the liquid line cock are open.
- Place the main switch SG on the control panel, in the position "1" in order to energize the crankcase heater(s)  
Unit power light will illuminate

**CAUTION :** energize the compressor heater(s) for a minimum of 12 hours before operating the unit..  
Make sure the crankcase is warm before starting the compressor.

- In the wiring diagram the terminals 78 and 79 are available for an external signal ; make a bridge in case there is no signal .
- If the unit is fitted with storage/circulating kit (PAC/P) select with the selector SFP the pumps operation.
- If unit is in heat pump mode ,place the cooling/heating selector SFP in the chosen operation mode.
- If the unit is controlled by an external supervisor ,make sure it is able to start the unit in cooling or heating.
- Place the SFMC switch on position "ON".  
After a certain time, adjustable from 5 to 10 minutes, the compressor will start.
- Check the fan motor rotate in correct direction and ,if necessary, reverse a phase after having opened the main switch
- Check the air flow to ensure the flow is within the utilization range.
- Check the water rate to ensure the flow is within the utilization range.
- In the event of malfunctioning, turn the unit off immediately by placing the SFMC selector "OFF" on the panel
- Check the flow of refrigerant through the sight glass is smooth and without bubbles, bubbles indicate a refrigerant shortage and probably a leak.
- Check the oil is visible in the compressor oil level sight glass.
- Run the unit for a minimum of 1 hour and make sure the moisture indicator indicates "dry circuit".

### Caution:

**All the unit controls can be placed in a remote control panel**



## Start up procedure :RSA –RHSA-SMAE+TCX-SMAE-H+THCX

- Check the compressor's intake and discharge cocks and the liquid line cock are open.
- Place the main switch SG on the control panel, in the position "1" in order to energize the crankcase heater(s)  
Unit power light will illuminate

CAUTION :energize the compressor heater(s) for a minimum of 12 hours before operating the unit..  
Make sure the crankcase is warm before starting the compressor.

- In the wiring diagram the terminals 78 and 79 are available for an external signal ; make a bridge in case there is no signal .
- Acting on the panel board ,place the fan operating selector SFMVM on position "ON"
- If the unit is controlled by an external supervisor ,make sure it is able to start the unit in cooling or heating.
- Check the fan motor rotate in correct direction and ,if necessary, reverse a phase after having opened the main switch
- Place the SFMC switch on position "ON".  
After a certain time, adjustable from 5 to 10 minutes, the compressor will start.
- Check the air flow to ensure the flow is within the utilization range.
- In the event of malfunctioning, turn the unit off immediately by placing the SFMVM selector "OFF" on the panel
- Check the flow of refrigerant through the sight glass is smooth and without bubbles ,Bubbles indicate a refrigerant shortage and probably a leak.
- Check the oil is visible in the compressor oil level sight glass.
- Run the unit for a minimum of 1 hour and make sure the moisture indicator indicates "dry circuit".

### Caution

**All the unit controls can be placed in a remote control panel**



## Operation

Compressor(s) operation is controlled by thermostat and a timer (when connected to the unit).

To stop the unit place selector SFMC on "OFF"

To start the unit again place the same selector on

When running, the adjustment thermostat and timer, if connected to the unit, will control compressor operation.

To stop the unit just place selector **SF** on «OFF».

To start the unit position the same selector «ON».

### Day or weekend shutdown

If the unit is to be shut down for a short period of time, act only on selector SFMC to stop and to start the unit. In such a way the crankcase heater remains in operation .

### Seasonal shutdown (by qualified service technician)

If the unit is to be shut down for long period of time place selector **SFMC** on «OFF» and next the unit's main switch **SG** on «0».

Open the system master switch. If the system is will be subject to freezing temperatures during the shutdown period, drain the tubes and piping completely.

The evaporator drain can be carried out through the drain cock.

### Seasonal start up (by qualified service technician)

*CAUTION: perform the applicable procedures outlined under "One year" in the maintenance section.*

Make sure the system is charged and check the pressure. If necessary refill the system according to FILLING THE SYSTEM procedures.

Open the compressor suction and discharge valves and the liquid line shutoff valve .

Test the entire refrigerant system for leaks.

Place the selector SG of the panel on position "1" to energize the crankcase heater.

*CAUTION: energize the compressor crankcase heater for a minimum of 12 hours before operating the unit. Ensure the crankcase heater is warm before starting the unit.*

Perform the applicable procedures outlined under START UP section



## **Maintenance**

*MAINTENANCE OPERATIONS MUST BE CARRIED OUT ONLY BY QUALIFIED AND EXPERIENCED ENGINEER.*

**Refrigerant leak test**

When there is a refrigerant leak during normal operation, inspect the piping and circuit for leaks with a leak detector.

Check every possible point of leakage and repeat it.

When mending requires the partial emptying of a circuit section, use suitable equipment to recover the refrigerant. Before overfilling the refrigerant in this case, it is necessary to pressure check tightness.

The overfilling must be carried out with refrigerant in gaseous phase (R22) or in liquid phase (R134a R407c) checking the charge through the sightglass.

**Pressurizing the circuit**

Pressurize the circuit or the repaired section with the valves closed.

Fill the section with dry nitrogen at a pressure of 12 bar and check any leaks using a soapy solution.

Bubbles indicate refrigerant shortage and probably a leak in which case check every possible point of leakage and all operations must be repeated.

Evacuate the system to a pressure of 113 Pa.

Interrupt suction of the pump and stop it.

Check that the pressure indicated on the vacuum meter remains constant. If there is an increase of pressure in the circuit a leak is indicated, in the case repeat all the operation described.

**Creating vacuum**

Be very thorough in this field evacuation procedure, because moisture inside the circuit is very dangerous for the compressor's windings and the controls.

*CAUTION: never use the compressor for field evacuation.*

Vacuum creating procedure:

- 1 -make sure that the circuit has been successfully pressurized.
- 2 -connect the vacuum pump as shown in the drawing.
- 3 -produce vacuum in the circuit at a pressure of 113 Pa.
- 4 -introduce dry nitrogen at a pressure of 12 bar.
- 5 -repeat the vacuum operation as per point 3.
- 6 -introduce nitrogen as per phase 4.
- 7 -produce vacuum in the circuit at a pressure of 113 Pa close pump suction, maintain circuit under vacuum for at least 3 hours.
- 8 -check that the pressure in the vacuum meter remains constant.



## Refrigerant Charging.

Charging can be done with refrigerant in the liquid state (R134a-R407c) or gaseous state(R22).

*CAUTION: in the liquid state charging has to be done with the circuit under vacuum, with the compressor still, with water circulating through the evaporator and following the instructions given below.*

### **Charging in the liquid state**

Connect the refrigerant cylinder to the service valve without tightening it.

Open the cylinder's valve to purge the connection, tighten the coupling nut and place the cylinder towards the bottom in such a way the liquid refrigerant will flow from the cylinder to the circuit.

Keep an accurate check on the quantity of refrigerant charged which should correspond to the values given in unit nameplate. For this purpose it is necessary to have scales for weighing or, alternatively, a cylinder preloaded at the required values.

Once the circuit has charged, close the cylinder valve, start the unit at max. capacity, checking the operation according to instructions outlined in section "CHECKING THE CHARGE"

Disconnect the connection pipe between unit and cylinder.

### **Charging in the gaseous state**

Charging in the gaseous state is required for topping-up the circuit when there is refrigerant shortage and after having accurately controlled tightness.

To charge in the gaseous state proceed as follows:

Allow the compressor to continue running.

Connect the refrigerant cylinder to the service valve without tightening it.

Open the cylinder's valve to purge the connection, tighten the coupling nut and place the cylinder towards the bottom in such a way the gaseous refrigerant will flow from the cylinder to the circuit.

Check the flow sightglass

Once the circuit has charged, close the cylinder valve, start the unit at max. capacity, checking the operation according to instructions outlined in section "CHECKING THE CHARGE"

Disconnect the connection pipe between unit and cylinder.

*CAUTION: do not charge in the liquid state as it could seriously damage the compressor. The cylinder must be placed vertically with the discharge connection at the top.*

*WARNING: do not charge any more than is actually necessary otherwise it would cause extensive compressor damage.*

*After charging, if required, check that superheat and subcooling values are within the right limit.*





## Checking the charge

If the system is properly charged superheating at the gaseous line should be 7- 8 °C , and subcooling at the liquid line access valve should be 4 – 6 ° C.

To check whether or not the values indicated have been reached, under normal operating conditions at full load, proceed as follows:

### ***superheating***

allow the unit to function in a normal manner checking that high and low pressure readings in the relevant gauges are constant.

Read the suction temperature just downstream the thermostatic valve's bulb. The difference between this temperature and saturation temperature read on the low pressure gauge must be within the described limits.

### ***subcooling***

Read the temperature of the liquid in outlet from the condenser. The difference between the saturation temperature seen on the high pressure gauge and that measured, must be within the described limits.



## Preventive maintenance

Regular preventive maintenance will highlight any malfunctioning and let you remedy it in time, minimizing the possibility of more serious problems. The system's value is also maintained over time.

WHAT TO DO	WEEKLY	MONTHLY	SIX MONTHLY	YEARLY
check the level of oil in the compressor's casing through the indicator glass	*	*	*	*
check the quantity of coolant and check humidity on the liquid passage indicator	*	*	*	*
check operating temperatures and pressures	*	*	*	*
inspect the unit to make sure there are no unusual conditions (compressor making too much noise, vibrations, pipes leaking)	*	*	*	*
check tightness of the refrigeration circuit using a leak detector, paying particular attention to joins and welded parts.		*	*	*
check that triggering of the thermostats and pressure switches complies with the values given in the calibration table.		*	*	*
check electrical absorption		*	*	*
inspect the contacts of the contactors and the control and safety instruments and devices.			*	*
check tightness of all the electrical connections on the various terminals.			*	*
check that all the sensor bulbs that detect temperatures are properly fitted inside their pockets and that contact is guaranteed with the special conductor paste.			*	*
check cleanliness and act accordingly.			*	*
clean the filters on the room air intake.			*	*
clean the exchange battery flaps with a steam nozzle.		*	*	*
check belt tension.		*	*	*
look for any loose bolts or screws; tighten them.				*
clean the unit, remove any rust that might have formed under certain environmental conditions and protect the repaired parts adequately.				*



## Application form

*In the event you need copy of this manual, drawings or information on the components installed, please contact A.C.M. head office sending the following form:*

*TO: after service department*

### applicant

Company: \_\_\_\_\_

Kind att. Of Mr. \_\_\_\_\_

Address: \_\_\_\_\_

\_\_\_\_\_

telephone: \_\_\_\_\_

Fax \_\_\_\_\_

**Unit:** \_\_\_\_\_

**Model:** \_\_\_\_\_

Nameplate number: \_\_\_\_\_

Date

Signature

\_\_\_\_\_